

NOTE

SCHIZAEA PUSILLA IN NORTH CAROLINA

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Schizaea pusilla Pursh, the curly-grass fern, has been found growing at a single location in a white cedar forest in Green Swamp in southeastern North Carolina. A survey of nearby suitable habitat has failed to establish the presence of another population, and an analysis of the extant site suggests that the population is introduced rather than native, raising problematic conservation issues. *Schizaea pusilla* has long been one of the most eagerly sought plants among professional and amateur botanists in North America. Its allure is certainly related to its rarity, its curious disjunct range, and its inconspicuous and unfernlike appearance. The distribution of *S. pusilla* is centered in the pine-lands of southern New Jersey, but includes nearby Long Island, New York, and Sussex County, Delaware, disjunct populations in Nova Scotia and Newfoundland, and a remarkably disjunct occurrence in Peru (Montgomery and Fairbrothers 1992; Stolze 1987; Wagner 1993).

The North Carolina Natural Heritage Program (Division of Parks and Recreation) has considered *Schizaea pusilla* among a list of species “not currently known to occur in North Carolina, but which are considered to have some possibility of being found in North Carolina, based on their currently known range and habitat preferences” (Amoroso 1997). *Schizaea pusilla* was considered as potentially occurring in the Coastal Plain and fall line sandhills in “boggy sphagnous sites associated with white cedar” (Amoroso 1997). The suggested possibility of finding *S. pusilla*

in North Carolina is based on the presence of potentially suitable habitat, and the close biogeographic and floristic relationship between the Coastal Plain Pine Barrens of southern New Jersey and Coastal Plain pinelands of southeastern North Carolina. This relationship is demonstrated by the many plant species exhibiting a disjunct distribution between the two areas, and often also involving other areas, such as the East Gulf Coastal Plain (Florida panhandle, southern Alabama, southwestern Georgia, southern Mississippi, and southeastern Louisiana), New Brunswick, and Nova Scotia. A few examples are *Rhynchospora pallida* M. A. Curtis, *Gentiana autumnalis* L., *Lophiola aurea* Ker Gawl., and *Leiophyllum buxifolium* (Bergius) Elliott.

Current floristic similarities are based on underlying habitat similarities, both areas having strongly acidic sandy soils, abundant saturated wetlands, and fire as a frequent and vegetation-shaping natural force. Moreover, these areas have had past connections, and during recent glacial periods, plant species now more typical of New Jersey, including *Schizaea pusilla*, occurred in North Carolina:

“At full-glacial time, a continuous coastal plain from Florida to Cape Cod was exposed. At the latitude of the Outer Banks, this plain was an estimated 90 miles in width; its vegetation can be partially reconstructed from palynological studies of the Dismal Swamp, Virginia, and southeastern North Carolina. . . . The forests of Virginia were apparently more boreal in aspect—spruce was possibly the dominant tree and fir was probably not uncommon. In southern North Carolina at this time, red or jack pine (perhaps both) were apparently the dominant species; spruce was much less abundant and fir was very uncommon. A number of northern species including *Lycopodium lucidulum*, *L. annotinum*, *Schizaea pusilla*, and *Sanguisorba canadensis* occurred” (Burk 1968).

Such recent vegetational similarities and the prehistoric occurrence of *S. pusilla* in North Carolina suggest the plausibility of the presence of relict populations.

On June 18, 1997, the first author discovered *Schizaea pusilla* in a moist, peaty opening in a forest community dominated by *Chamaecyparis thyoides* (L.) Britton, Sterns & Poggenb. at Green

Swamp in Brunswick County, North Carolina (portion of one individual collected, 18 Jun 1997, *LeBlond 4757*, NCU). On June 22, 1997, the two authors returned to the site and conducted a careful investigation, and also investigated four other *Chamaecyparis* stands in the vicinity. The *Chamaecyparis* stands themselves were searched, as well as nearby open habitats, such as boggy areas and moist savanna edges. This strategy was suggested by the habitat of the species in New Jersey: “*Schizaea* occurs in the open bogs, not within dense white cedar forests. Plants are found at bases of young or isolated cedar trees, or stumps or logs, or on edges of peat hummocks including edges of old sand roads” (Montgomery and Fairbrothers 1992).

At the discovery site, six individuals of *Schizaea pusilla* grew on a peat hummock about 1 m by 0.5 m, and about 3 dm high. The hummock was in one of many small openings in an otherwise dense *Chamaecyparis* stand, which is classified as a *Chamaecyparis thyoides*/*Persea palustris*/*Lyonia lucida* – *Ilex coriacea* Forest (Weakley et al. 1998) or as Peatland Atlantic White Cedar Forest (Schafale and Weakley 1990). Immediately associated with *S. pusilla* were *Drosera intermedia* Hayne, *D. rotundifolia* L., *D. filiformis* Raf., seedlings of *C. thyoides*, seedlings of *L. lucida* (Lam.) K. Koch, and *Sphagnum* spp. More generally associated in the surrounding community were *C. thyoides*, *Cyrtilla racemiflora* L., *Vaccinium formosum* Andr., *Gaylussacia frondosa* (L.) Torr. & A. Gray *sensu stricto*, *Eubotrys racemosa* (L.) Nutt., *Persea palustris* (Raf.) Sargent, *Smilax laurifolia* L., *Ilex myrtifolia* Walter, *I. coriacea* (Pursh) Chapm., and *Myrica heterophylla* Raf. Some of these species are frequently associated with *S. pusilla* in its occurrences in southern New Jersey (D. Snyder, pers. comm., New Jersey Natural Heritage Program), and it is notable that Montgomery and Fairbrothers (1992) state that “the best indicator associates are thread-leaf sundew (*Drosera filiformis*) and Carolina clubmoss (*Lycopodium carolinianum*).”

Four additional white cedar stands and associated open habitats were searched carefully, and although microhabitats similar to those at the first site were seen, no plants of *Schizaea pusilla* were found. This raised the question of whether the discovered population of *S. pusilla* is native, or is the result of planting (or the intentional or unintentional scattering of spores by a human). We considered the following lines of evidence:

1. The habitat, location, and associated species are very plausible for a native occurrence of *Schizaea pusilla* in southeastern North Carolina, showing similarities to its natural habitats in southern New Jersey.
2. The site with *Schizaea pusilla* is one of the most accessible and well-known white cedar stands in southeastern North Carolina, and has a small trail into it from a nearby road. The additional four stands investigated (and lacking *S. pusilla*) have less ready access.
3. The small trail into the *Schizaea pusilla* site had been flagged relatively recently, and a flagged wooden stake of unknown purpose was in the opening on the hummock supporting *Schizaea*.
4. The second author had searched the site for *Schizaea pusilla* in late 1980s and did not find any. Of course, *S. pusilla* is an inconspicuous plant, and the opening which has created apparently excellent conditions for *S. pusilla* is recent.
5. Growing within a few centimeters of *Schizaea pusilla* were a few individuals of both *Drosera rotundifolia* and *D. filiformis*. *Drosera rotundifolia* is not known to occur in southeastern North Carolina (though it does occur in the mountains of North Carolina, with a few disjunct populations in the fall line sandhills). *Drosera filiformis* (*sensu stricto*) is a rare plant in southeastern North Carolina, known from eight extant populations. Notably, its habitat in North Carolina is in open seasonally-flooded depressional wetlands, and it has not been known to occur in, or in proximity to, *Chamaecyparis* stands in North Carolina. This suggests that both *Drosera* species were introduced as seeds or small plants along with *S. pusilla*; it is also possible that *D. filiformis* rather than *Schizaea* was the intentional introduction. An alternative interpretation would be that notably disjunct populations often indicate unusual habitats or relictual conditions, and that disjunct populations of other species often co-occur at such sites.
6. The plants of *Schizaea pusilla* were examined carefully to assess whether they had been transplanted. They appeared to be well established. No apparent discontinuity of soil could be seen; the peaty material at the immediate base of the plants appeared no different than that in the vicinity. If the plants were transplanted, it is likely that they have been

at the site for at least several years, with enough time having passed for the incorporation and intermeshing of soil material.

7. The authors have seen a privately printed document which reports that four occurrences of *Schizaea* have been known from Green Swamp since the early 1990s (Murray 1995). The author of this privately printed document is a naturalist familiar with habitats in both the New Jersey Pine Barrens and southeastern North Carolina, but we are not convinced that these reported populations are naturally occurring. In our opinion they are likely based on deliberate introductions.
8. *Schizaea pusilla* has previously been the subject of a deliberate introduction to a new state, into an artificial cranberry bog in Massachusetts (B.A. Sorrie, pers. comm., formerly of Massachusetts Natural Heritage Program).

The authors conclude that the preponderance of evidence suggests that the single site of *Schizaea pusilla* discovered in North Carolina is the result of transplantation, but that it is also plausible (though less likely) that this represents a native population. Based on current evidence, *S. pusilla* is best considered a nonindigenous and marginally naturalized component of the North Carolina flora. Even if this population is the result of introduction, it remains possible that *S. pusilla* occurs in North Carolina at undiscovered native populations; botanists should continue to seek *S. pusilla* in likely habitats in North Carolina and adjacent eastern South Carolina and southeastern Virginia.

It is unfortunate that the native/introduced status of *Schizaea pusilla* in North Carolina cannot be determined more definitively. If native, the newly discovered population would warrant considerable conservation effort, attention, and resources by conservation organizations and governmental agencies responsible for the conservation of biodiversity in North Carolina; if introduced, it would not. Uncertainty about the native status of populations of plants causes difficulties for scientists, conservation organizations, and government agencies in determining the native distributions of taxa, and the appropriate conservation priorities and actions needed. Plants with high profiles in the amateur botanical world, such as orchids, ferns, and insectivorous species, are particularly likely to be introduced to areas outside their native dis-

tributions, and then be found and reported as range extensions. Examples include *Dionaea muscipula* J. Ellis in Alabama, Florida, western North Carolina, Virginia, and southern New Jersey (all introduced); *Drosera filiformis* and *D. intermedia* in West Virginia (considered introduced); *Sarracenia leucophylla* Raf. in eastern North Carolina (probably introduced); and various *Sarracenia* spp. in eastern Virginia and New Jersey (introduced).

The authors urge that the introduction of species to natural areas, such as nature preserves or multiple-use public conservation lands, be avoided. It has been abundantly documented that such introduced species can cause unforeseen management problems (though in this case it is difficult to imagine curly-grass fern as a pest species outcompeting another species!). Even if the deliberate introduction does not become a problem, other species are often introduced unintentionally as well, and these may become aggressive colonizers. If species are introduced, every effort should be made to document their introduced status in the published literature to avoid future confusion regarding native distributions, and conservation and management priorities.

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